

TABLE 3.—Solar radiation measurements, and determinations of atmospheric factor,  $\beta$ , Washington, D. C., January, 1933—Con.

[Values in italics have been interpolated]

| Date and solar hour angle | Solar altitude, $h$ . | Air mass, $m$ . | $I_m$                 | $I_r$                | $I_t$                | $\beta$ | Blue-ness of sky | Atmospheric dust particles per cubic centimeter | Notes: Sky-light polarization, P., clouds, etc. |
|---------------------------|-----------------------|-----------------|-----------------------|----------------------|----------------------|---------|------------------|---|---|
| <b>1933</b>               |                       |                 |                       |                      |                      |         |                  |   |   |
| <b>Jan. 24</b>            |                       |                 |                       |                      |                      |         |                  |   |   |
| 2:38 a.                   | 21-08                 | 2.76            | <i>gr. cal.</i> 1.107 | <i>gr. cal.</i> .853 | <i>gr. cal.</i> .693 | .070    |                  |   |   |
| 2:28 a.                   | 20-22                 | 2.61            | 1.139                 | .856                 | .699                 | .070    |                  |   |   |
| 2:04 a.                   | 20-04                 | 2.36            | 1.145                 | .870                 | .703                 | .080    |                  |   |   |
| 0:52 a.                   | 30-38                 | 1.96            | 1.241                 | .945                 | .711                 | .070    | 4                |   | P=55.8.   |
| 0:44 a.                   | 30-50                 | 1.94            | 1.274                 | .945                 | .714                 | .065    |                  |   |   |
| 0:04 a.                   | 31-54                 | 1.89            | 1.276                 | .945                 | .747                 | .075    |                  |   |   |
| 0:00 noon                 | 31-54                 | 1.89            | 1.300                 | .945                 | .748                 | .070    |                  |   |   |
| 1:08 p.                   | 29-45                 | 2.01            | 1.292                 | .916                 | .746                 | .065    |                  |   |   |
| 1:12 p.                   | 29-30                 | 2.02            | 1.303                 | .918                 | .747                 | .060    |                  |   |   |
| 2:08 p.                   | 24-39                 | 2.39            | 1.200                 | .907                 | .705                 | .055    |                  |   |   |
| 2:12 p.                   | 24-13                 | 2.43            | 1.203                 | .970                 | .708                 | .055    |                  |   |   |
| <b>Jan. 30</b>            |                       |                 |                       |                      |                      |         |                  |   |   |
| 3:28 a.                   | 15-28                 | 3.70            | 1.067                 | .864                 | .702                 | .065    |                  |   | 355   |
| 3:17 a.                   | 16-31                 | 3.49            | 1.150                 | .967                 | .704                 | .040    |                  |   |   |
| 2:30 a.                   | 23-31                 | 2.50            | 1.200                 | .948                 | .786                 | .045    |                  |   |   |
| 2:24 a.                   | 24-15                 | 2.43            | 1.216                 | .951                 | .789                 | .045    |                  |   |   |
| 1:41 a.                   | 28-56                 | 2.06            | 1.355                 | .999                 | .814                 | .060    |                  |   |   |
| 1:33 a.                   | 29-21                 | 2.04            | 1.310                 | 1.015                | .817                 | .085    |                  |   |   |
| <b>Jan. 31</b>            |                       |                 |                       |                      |                      |         |                  |   |   |
| 3:36 a.                   | 14-27                 | 3.97            | .909                  | .717                 | .606                 | .070    |                  |   | 389   |
| 3:31 a.                   | 15-14                 | 3.77            | .906                  | .720                 | .609                 | .080    |                  |   |   |
| 3:08 a.                   | 18-39                 | 3.11            | 1.016                 | .802                 | .655                 | .080    |                  |   |   |
| 3:02 a.                   | 19-30                 | 2.98            | 1.029                 | .804                 | .658                 | .085    |                  |   |   |
| 3:42 a.                   | 22-15                 | 2.63            | 1.032                 | .846                 | .695                 | .115    |                  |   |   |
| 2:34 a.                   | 23-16                 | 2.51            | 1.126                 | .847                 | .697                 | .080    |                  |   |   |
| 2:03 a.                   | 26-54                 | 2.21            | 1.174                 | .885                 | .711                 | .085    |                  |   |   |
| 1:58 a.                   | 27-24                 | 2.17            | 1.174                 | .888                 | .712                 | .085    |                  |   |   |
| 1:22 a.                   | 30-35                 | 1.66            | 1.221                 | .897                 | .723                 | .080    | 5                |   | P=58.3.   |
| 1:18 a.                   | 30-53                 | 1.94            | 1.243                 | .900                 | .726                 | .075    |                  |   |   |

## POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

| Date                               | Eastern<br>standard<br>civil time | Heliographic   |                |              | Area |       | Total<br>area<br>for<br>each<br>day |
|------------------------------------|-----------------------------------|----------------|----------------|--------------|------|-------|-------------------------------------|
|                                    |                                   | Diff.<br>long. | Longi-<br>tude | Lat-<br>tude | Spot | Group |                                     |
| 1933                               |                                   |                |                |              |      |       |                                     |
| Jan. 1 (Naval Observatory)-----    | 12 29                             |                | °              | °            |      |       |                                     |
| Jan. 2 (Naval Observatory)-----    | 11 40                             |                | No spots.      |              |      |       |                                     |
| Jan. 3 (Naval Observatory)-----    | 13 23                             | -70.0          | 328.1          | +11.0        | 185  |       | 185                                 |
| Jan. 4 (Naval Observatory)-----    | 11 3                              | -74.0          | 313.3          | +11.0        |      | 185   |                                     |
|                                    |                                   | -59.0          | 328.3          | +11.0        | 170  |       | 355                                 |
| Jan. 5 (Naval Observatory)-----    | 14 6                              | -59.0          | 313.5          | +10.0        |      | 154   |                                     |
|                                    |                                   | -44.0          | 328.5          | +10.0        | 154  |       | 308                                 |
| Jan. 6 (Naval Observatory)-----    | 12 15                             | -46.0          | 314.3          | +9.0         | 93   |       |                                     |
|                                    |                                   | -32.0          | 328.3          | +10.0        | 154  |       | 247                                 |
| Jan. 7 (Mount Wilson)-----         | 12 50                             | -32.0          | 314.9          | +9.0         | 110  |       |                                     |
|                                    |                                   | -18.0          | 328.9          | +11.0        | 126  |       | 236                                 |
| Jan. 8 (Naval Observatory)-----    | 13 1                              | -18.0          | 315.6          | +10.0        | 123  |       |                                     |
|                                    |                                   | -4.0           | 329.6          | +11.0        | 154  |       | 277                                 |
| Jan. 9 (Mount Wilson)-----         | 13 50                             | -5.0           | 315.0          | +9.0         | 109  |       |                                     |
|                                    |                                   | +9.0           | 329.0          | +11.0        | 166  |       | 275                                 |
| Jan. 10 (Naval Observatory)-----   | 11 55                             | +8.0           | 315.8          | +10.0        |      | 154   |                                     |
|                                    |                                   | +22.0          | 329.8          | +11.0        | 139  |       | 293                                 |
| Jan. 11 (Perkins Observatory)----- | 15 40                             | +20.0          | 312.6          | +11.0        | 70   |       |                                     |
|                                    |                                   | +32.0          | 324.6          | +11.0        | 70   |       | 140                                 |

## POSITIONS AND AREAS OF SUN SPOTS—Continued

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| Date                                  | Eastern<br>standard<br>civil time |           | Heliographic   |                |              | Area |       | Total<br>area<br>for<br>each<br>day |
|---------------------------------------|-----------------------------------|-----------|----------------|----------------|--------------|------|-------|-------------------------------------|
|                                       |                                   |           | Diff.<br>long. | Longi-<br>tude | Lat-<br>tude | Spot | Group |                                     |
| 1933                                  |                                   |           |                |                |              |      |       |                                     |
| Jan. 12 (Naval Observatory)-----      | <i>h.</i>                         | <i>m.</i> | °              | °              | °            |      |       |                                     |
|                                       | 13                                | 30        | +4.0           | 284.6          | +8.0         |      | 31    |                                     |
|                                       |                                   |           | +36.0          | 316.6          | +10.0        | 123  |       |                                     |
|                                       |                                   |           | +49.0          | 329.6          | +11.0        | 139  |       | 293                                 |
| Jan. 13 (Perkins Observatory)-----    | 15                                | 0         | +5.0           | 271.7          | +5.0         |      | 45    |                                     |
|                                       |                                   |           | +34.0          | 300.7          | +15.0        |      | 50    |                                     |
|                                       |                                   |           | +46.0          | 312.7          | +11.0        | 70   |       |                                     |
|                                       |                                   |           | +59.0          | 325.7          | +11.0        | 70   |       | 235                                 |
| Jan. 14 (Mount Wilson)-----           | 12                                | 0         | +20.0          | 275.1          | +3.0         |      | 53    |                                     |
|                                       |                                   |           | +51.0          | 306.1          | +15.0        |      | 74    |                                     |
|                                       |                                   |           | +62.0          | 317.1          | +10.0        | 85   |       |                                     |
|                                       |                                   |           | +75.0          | 330.1          | +11.0        | 171  |       | 333                                 |
| Jan. 15 (Naval Observatory)-----      | 13                                | 16        | +33.0          | 274.2          | +3.0         |      | 37    |                                     |
|                                       |                                   |           | +66.0          | 307.2          | +14.0        |      | 62    |                                     |
|                                       |                                   |           | +76.0          | 317.2          | +10.0        | 108  |       | 207                                 |
| Jan. 16 (Naval Observatory)-----      | 10                                | 43        | +46.0          | 275.5          | +2.0         |      | 19    | 19                                  |
| Jan. 18 (Harvard Observatory)-----    |                                   |           | No spots.      |                |              |      |       |                                     |
| Jan. 19 (Perkins Observatory)-----    | 13                                | 15        | No spots.      |                |              |      |       |                                     |
| Jan. 20 (Naval Observatory)-----      | 11                                | 5         | No spots.      |                |              |      |       |                                     |
| Jan. 22 (Naval Observatory)-----      | 16                                | 25        | No spots.      |                |              |      |       |                                     |
| Jan. 23 (Naval Observatory)-----      | 10                                | 20        | No spots.      |                |              |      |       |                                     |
| Jan. 24 (Naval Observatory)-----      | 10                                | 44        | No spots.      |                |              |      |       |                                     |
| Jan. 28 (Naval Observatory)-----      | 10                                | 47        | -58.0          | 13.4           | +6.0         |      | 31    | 31                                  |
| Jan. 29 (Naval Observatory)-----      | 11                                | 19        | -44.0          | 14.0           | +5.0         |      | 154   | 154                                 |
| Jan. 30 (Naval Observatory)-----      | 10                                | 56        | -79.0          | 326.0          | +12.0        | 123  |       |                                     |
|                                       |                                   |           | -33.0          | 12.0           | +4.0         |      | 50    |                                     |
|                                       |                                   |           | -26.0          | 19.0           | +5.0         |      | 77    | 250                                 |
| Jan. 31 (Naval Observatory)-----      | 11                                | 5         | -88.0          | 303.8          | +16.0        | 247  |       |                                     |
|                                       |                                   |           | -64.0          | 327.8          | +12.0        |      | 108   |                                     |
|                                       |                                   |           | -15.0          | 16.8           | +6.0         |      | 216   | 571                                 |
| Mean daily area for Janu-<br>ary----- |                                   |           |                |                |              |      |       | 172                                 |

## PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR JANUARY, 1933

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

| January, 1933 | Relative numbers | January, 1933 | Relative numbers | January, 1933 | Relative numbers |
|---------------|------------------|---------------|------------------|---------------|------------------|
| 1             | 0                | 11            | 17               | 21            | 0                |
| 2             | 0                | 12            | Mc 26            | 22            | 0                |
| 3             | d 7              | 13            | 37               | 23            | 0                |
| 4             | 14               | 14            | 32               | 24            | 0                |
| 5             | 17               | 15            | 27               | 25            | 0                |
| 6             | 17               | 16            | 14               | 26            | 0                |
| 7             | 19               | 17            | 7                | 27            | 0                |
| 8             |                  | 18            | 0                | 28            | Ec 9             |
| 9             | a                | 19            |                  | 29            | 10               |
| 10            | a 18             | 20            | 0                | 30            |                  |
|               |                  |               |                  | 31            | a 35             |

Mean: 27 days=11.3.

a= Passage of an average-sized group through the central meridian.  
b= Passage of a large group or spot through the central meridian.  
c= New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.  
d= Entrance of a large or average-sized center of activity on the east limb.

## AEROLOGICAL OBSERVATIONS

[Aerological Division, W. R. Gregg, in charge]

By L. T. SAMUELS

Free-air temperatures during January averaged decidedly above normal except at San Diego, where small negative departures occurred. (See Table 1.) The largest positive departures occurred in the lower levels at Omaha and Washington. Relative humidities averaged close to normal at most stations, with the greatest deviations occurring at Omaha where the departures were negative.

In harmony with the large positive temperature departures, the monthly free-air resultant wind directions

contained either greater southerly or smaller northerly components than normal at the corresponding stations. In most cases the resultant velocities were above normal. At 3,000 meters elevation and above, however, but little deviation from the normal directions occurred.

Airplane observations were made daily throughout the month at the Weather Bureau stations, with the exception of the 21st at Chicago when, dense fog continued all day.